CLAIMS

1. A method for manufacturing a composite trim part which is arranged to be mounted in particular in an automotive vehicle to form a part of the interior thereof and which comprises a three-dimensionally shaped laminate of a flexible skin layer (1), a rigid backing substrate layer (2) and an intermediate layer (3), in particular a foam layer, arranged between the flexible skin layer and the rigid substrate layer and adhering the flexible skin layer and the rigid substrate layer to one another, the method comprising the steps of:

- providing a mould (5, 8) comprising a first mould half (5), having a first mould surface (4) with a predetermined three-dimensional shape, and a second mould half (8), having a second mould surface (7) with a further predetermined three-dimensional shape, the first and second mould halves being movable with respect to one another to open and close said mould (5, 8) and defining a first mould cavity (11) in the closed mould position;
- forming the flexible skin layer (1) with its front side against the first mould surface (4) according to a low pressure forming process;
- forming said rigid substrate layer (2) with its back side against the second mould surface (7);
- bringing both mould halves (5, 8) together to close the mould (5, 8), with a gap remaining between the skin layer (1) on the first mould surface (4) and the substrate layer (2) on the second mould surface (7);
- applying a curable material between the skin layer (1) on the first mould surface (4) and the substrate layer (2) on the second mould surface (7), and allowing it to cure in the closed position of the mould (5, 8) to produce the intermediate layer (3) in said gap, the curable material being in particular a foamable material which is allowed to foam in the closed position of the mould (5, 8) ; and

– opening the mould (5, 8) and removing the moulded trim part therefrom,

characterised in that said substrate layer (2) is formed with its back side against the second mould surface (7) according to a further low pressure forming process, said low pressure forming process and said further low pressure forming process being selected, independently from one another, from the group consisting of a spray process, a reaction injection moulding process, a liquid or powder slush moulding process and a thermoforming process.

2. A method according to claim 1, characterised in that said rigid substrate layer (2) is formed with its back side against the second mould surface (7) by thermoforming a sheet of a thermoplastic material against the second mould surface (7).

3. A method according to claim 1, characterised in that said rigid substrate layer (2) is formed with its back side against the second mould surface (7) by applying at least one flowable and/or molten substrate material onto the second mould surface (7) and allowing this flowable substrate material to harden to produce the rigid substrate layer (2) on this second mould surface (7).

4. A method according to claim 3, characterised in that said flowable substrate material comprises a liquid reaction mixture composed to produce a rigid polyurethane substrate layer (2).

5. A method according to claim 4, characterised in that said liquid reaction mixture is sprayed onto the second mould surface (7).

6. A method according to claim 4, characterised in that for producing the rigid substrate layer (2) on the second mould surface (7), a further first mould half (15), having a further first mould surface (46) arranged to cooperate with the second mould surface (7) to define a second mould cavity (16), is provided, and the rigid substrate layer is produced in this second mould cavity, in accordance with a reaction

injection moulding technique, by injecting said reaction mixture in this second mould cavity (16) and allowing it to cure therein, the further first mould half (15) being removed from the second mould half (8) before bringing the first and second mould halves (5, 8) together, with the produced rigid substrate layer (2) remaining on the second mould surface (7).

7. A method according to claim 3, characterised in that said rigid substrate layer (2) is made from a thermoplastic substrate material in accordance with a slush moulding process, in particular in accordance with a liquid or powder slush moulding process.

8. A method according to any one of the claims 1 to 7, characterised in that said skin layer (1) is produced on the first mould surface (4) by applying at least one flowable and/or molten skin material onto the first mould surface (4) and allowing this flowable skin material to harden to produce the skin layer (2) on this first mould surface (4).

9. A method according to any one of the claims 3 to 8, characterised in that at least an electrical and/or mechanical component (18) is embedded in the flowable and/or molten substrate material when forming the rigid substrate layer (2) against said second mould surface (7), the electrical and/or mechanical component comprising preferably at least one electrical connector part (54, 55), in particular an electrical connector part (54) arranged to make an electrical connection on the back side of the trim part when mounting it.

10. A method according to claims 8 and 9, characterised in that said electrical and/or mechanical component (18) comprises an electrical connector part (55) on the front side of the substrate layer and in that at least a further electrical and/or mechanical component (56), comprising a further electrical connector part (59), is embedded in the flowable and/or molten skin material when forming the flexible skin layer (1) against the first mould surface (4), the further electrical connector part

(59) being adapted to form an electrical connection with the electrical connector part (55) of the component embedded in the rigid substrate layer (2), the further electrical and/or mechanical component (56) being embedded in such a location in the flexible skin layer (1) that, when closing the first mould cavity (11), the further electrical connector part (59) is electrically connected to the electrical connector part (55) of the component embedded in the rigid substrate layer (2).

11. A method according to any one of the claims 1 to 10, characterised in that said rigid substrate layer (2) has a predetermined surface area, at least one reinforcement material being embedded in the rigid substrate layer, the rigid substrate layer being divided in at least two zones, in a first one of which (48, 49) the rigid substrate layer contains a predetermined amount of said reinforcement material whilst, in a second of said zones (45), the rigid substrate layer does not contain said reinforcement material or a smaller amount thereof, the first zone (48, 49) covering preferably at the most 90%, more preferably at the most 60% and most preferably at the most 30% of said predetermined surface area, the first zone covering more preferably at least 2% and most preferably at least 4% of said predetermined surface area.

12. A method according to any one of the claims 1 to 11, characterised in that the predetermined three-dimensional shape of the first mould surface corresponds generally to the predetermined three-dimensional shape the second mould surface

13. A method according to any one of the claims 1 to 12, characterised in that, for manufacturing the trim part, the first mould half (5) is passed through a first circuit of successive workstations (25-31 and 36-40 and 42-43) and the second mould half (8) through a second circuit of successive workstations (32-41), the first and the second circuit comprising a chain of successive workstations (36-40) which are common to the first and the second circuit and which comprise a first

workstation (36), wherein the first and second mould halves are joined to one another, and a last workstation (40), which is situated downstream the first workstation and wherein the first and second mould halves are released from one another, the first circuit comprising further a first chain of successive workstations (25-31 and 42-43), through which the first mould half (5) is passed separated from the second mould half (8), and the second circuit comprising further a second chain of successive workstations (32-35 and 41), through which the second mould part is passed separated from the first mould part, the intermediate layer being produced in said common chain of workstations (36-40) whilst the flexible skin layer (1) is produced in said first chain of workstations and the rigid substrate layer (2) in said second chain of workstations.

14. A method for manufacturing a composite trim part which is arranged to be mounted in particular in an automotive vehicle to form a part of the interior thereof and which comprises a laminate of a flexible skin layer (1), a rigid backing substrate layer (2) and an intermediate layer (3), in particular a foam layer, arranged between the flexible skin layer and the rigid substrate layer and adhering the flexible skin layer and the rigid substrate layer to one another, the method comprising the steps of:

- providing a mould (5, 8) comprising a first mould half (5), having a first mould surface (4), and a second mould half (8), having a second mould surface (7), the first and second mould halves (5, 8) being movable with respect to one another to open and close said mould (5, 8) and defining a first mould cavity (11) in the closed mould position;
- applying at least one flowable and/or molten skin material onto the first mould surface (4) and allowing this flowable skin material to harden to produce the flexible skin layer (1) on this first mould surface (4);
- applying said rigid substrate layer (2) on the second mould surface (7);

- bringing both mould halves (5, 8) together to close the mould (5, 8), with a gap remaining between the skin layer on the first mould surface and the substrate layer on the second mould surface;
- applying a curable material between the skin layer (1) on the first mould surface (4) and the substrate layer (2) on the second mould surface (7), and allowing it to cure in the closed position of the mould (5, 8) to produce the intermediate layer (3) in said gap, the curable material being in particular a foamable material which is allowed to foam in the closed position of the mould (5, 8); and
- opening the mould (5, 8) and removing the moulded trim part therefrom,

characterised in that, for carrying out said steps, the first mould half (5) is passed through a first circuit of successive workstations (25-31 and 36-40 and 42-43) and the second mould half (8) through a second circuit of successive workstations (44 and 36-41 or 32-41), the first and the second circuit comprising a chain of successive workstations (36-40) which are common to the first and the second circuit and which comprise a first workstation (36), wherein the first and second mould halves are joined to one another, and a last workstation, which is situated downstream the first workstation and wherein the first and second mould halves are released from one another, the first circuit comprising further a first chain of successive workstations (25-31 and 42-43), through which the first mould half (5) is passed separated from the second mould half (8), the intermediate layer being produced in said common chain of workstations (36-40) whilst the flexible skin layer is produced in said first chain of workstations, the rigid substrate layer (2) being either applied on the second mould surface (7) in said common chain of workstations (36-40) or the second circuit of successive workstations comprises, in addition to said common chain of workstations, at least one workstation

(44 or 33-35) wherein the rigid substrate layer is applied on the second mould surface.

15. A method according to claim 14, characterised in that said rigid substrate layer (2) is applied on the second mould surface (7) by positioning a pre-manufactured rigid substrate layer thereon or by thermoforming a sheet of a thermoplastic material against the second mould surface.

16. A method according to any one of the claims 13 to 15, characterised in that said second mould half (8) is passed through the second circuit of successive workstations while the first mould half is being passed through the first circuit of successive workstations.

17. A method according to any one of the claims 13 to 16, characterised in that said first circuit forms a first closed loop followed by a first number of first mould halves (5) whilst said second circuit forms a second closed loop followed by a second number of second mould halves (8), said first and second numbers being larger than 1, preferably larger than 2, and said second number being preferably smaller than said first number, said first closed loop of successive workstations comprising preferably at least one workstation (25) for exchanging one first mould half by another first mould half and said second closed loop of successive workstations comprising preferably at least one workstation (32) for exchanging one second mould half by another second mould half, the first mould halves following the first circuit and the second mould halves following the second circuit being preferably of at least two different types.

18. A method according to claim 8 or according to any one of the claims 14 to 17, characterised in that said flowable skin material comprises a liquid reaction mixture composed to produce an elastomeric polyurethane skin layer, having an average density higher

than 200 kg/m³, preferably higher than 400 kg/m³ and more preferably higher than 700 kg/m³.

19. A method according to claim 18, characterised in that said reaction mixture is sprayed onto the first mould surface (4).

20. A method according to claim 18, characterised in that for producing the flexible skin layer (1) on the first mould surface (4), a further second mould half (12), having a further second mould surface (47) arranged to cooperate with the first mould surface (4) to define a third mould cavity (13), is provided, and the flexible skin layer (1) is produced in this third mould cavity (13), in accordance with a reaction injection moulding technique, by injecting said reaction mixture in this third mould cavity (13) and allowing it to cure therein, the further second mould half (12) being removed from the first mould half (5) before bringing the first and second mould halves (5, 8) together, with the produced flexible skin layer (1) remaining on the first mould surface (4).

21. A method according to claim 8 or according to any one of the claims 14 to 17, characterised in that the flexible skin layer (1) is produced against the first mould surface (4) according to a slush moulding process, in particular according to a liquid or a powder slush moulding process.

22. A method according to claim 8 or according to any one of the claims 14 to 21, characterised in that the flowable and/or molten skin material is applied in such an amount that said flexible skin layer (1) has an average thickness of between 0.1 and 3 mm, and preferably of between 0.2 and 2 mm.

23. A method according to any one of the claims 1 to 22, characterised in that upon closing the mould (5, 8) , the flexible skin layer (1) and the substrate layer (2) are pressed onto one another over a contact zone (22) having a width smaller than 10 mm, preferably smaller than 5 mm, and more preferably smaller than 3 mm, the flexible skin

layer (1) having, before closing the mould, in said contact zone (22) a thickness of at least 0.3 mm, and preferably of at least 0.4 mm, and the contact zone (22) having preferably a width larger than 1 mm, more preferably larger than or equal to 2 mm.

24. A method according to claim 23, characterised in that a flowable and/or molten skin material which requires hardening to produce the skin layer, is applied onto the first mould surface and/or a flowable and/or molten substrate material which requires hardening to produce the substrate layer, is applied onto the second mould surface and the mould is closed when the skin material and/or the substrate material applied in said contact zone is not completely hardened.

25. A method for manufacturing a composite trim part which is arranged to be mounted in particular in an automotive vehicle to form a part of the interior thereof and which comprises a laminate of a flexible skin layer (1), a rigid backing substrate layer (2) and an intermediate layer (3), in particular a foam layer, arranged between the flexible skin layer and the rigid substrate layer and adhering the flexible skin layer and the rigid substrate layer to one another, the method comprising the steps of:

- providing a mould (5, 8) comprising a first mould half (5), having a first mould surface (4), and a second mould half (8), having a second mould surface (7), the first and second mould halves being movable with respect to one another to open and close said mould (5, 8) and defining a first mould cavity (11) in the closed mould position;
- applying said flexible skin layer (1) on the first mould surface (4) and said rigid substrate layer (2) on the second mould surface (7);
- bringing both mould halves (5, 8) together to close the mould (5, 8), with a gap remaining between the skin layer on the first mould surface and the substrate layer on the second mould surface;

- applying a curable material between the skin layer (1) on the first mould surface (4) and the substrate layer (2) on the second mould surface (7), and allowing it to cure in the closed position of the mould cavity (5, 8) to produce the intermediate layer (3) in said gap, the curable material being in particular a foamable material which is allowed to foam in the closed position of the mould (5, 8) ; and
- opening the mould (5, 8) and removing the moulded trim part therefrom,

characterised in that, upon closing the mould (5, 8) , the flexible skin layer (1) and the substrate layer (2) are pressed onto one another over a contact zone (22) having a width smaller than 10 mm, preferably smaller than 5 mm, and more preferably smaller than 3 mm, the flexible skin layer (1) having in said contact zone (22), before closing the mould (5, 8), a thickness of at least 0.3 mm, and preferably of at least 0.4 mm, and the contact zone (22) having preferably a width larger than 1 mm, more preferably larger than or equal to 2 mm.

26. A method according to any one of the claims 23 to 25, characterised in that said flexible skin layer (1) is applied on the first mould surface (4) by spraying a liquid reaction mixture composed to produce an elastomeric polyurethane skin layer onto the first mould surface (4), the first mould surface being provided in said contact zone (22) with an upstanding edge (20) having a top surface (21) shaped to enable to spray a layer of said reaction mixture of at least 0.3 mm on said top surface, said top surface being in particular substantially flat and having a width of at least 1 mm, preferably of at least 2 mm or said top surface is convex and shows an overall curvature radius larger than or equal to 2 mm.

27. A method according to any one of the claims 23 to 26, characterised in that the first mould surface (4) comprises at least two temperature areas, namely a first area, situated outside said contact

zone (22), wherein the first mould surface (4) has a predetermined temperature when closing the first mould cavity (11), and a second area, comprising said contact zone (22), wherein the first mould surface (4) is heated to a higher temperature when closing the mould (5, 8).

28. A method according to any one of the claims 1 to 27, characterised in that a trim part is made wherein said flexible skin layer (1) has a flexural modulus, measured according to ASTM D790, lower than 100 MPa, and preferably lower than 75 MPa, and wherein said rigid substrate layer (2) has a flexural modulus, measured according to DIN EN 310, higher than 100 MPa, preferably higher than 200 MPa and more preferably higher than 300 MPa.

29. A method according to any one of the claims 1 to 28, characterised in that a trim part is made wherein the intermediate layer (3), in particular the foam layer (3), has an average thickness larger than 2 mm, preferably larger than 3 mm.